

14th Annual Pyrochemical Workshop
The Broker Inn-Boulder, Colorado
October 31-November 3, 1994

**RECOVERY OF PLUTONIUM METAL BY A
HYDRIDE/DEHYDRIDE/CAST PROCESS (HYDEC)***

Carlos A. Colmenares
Mark C. Bronson
David E. Petersen
Lawrence Livermore National Laboratory
Livermore, California 94550

ABSTRACT

A multi-chamber apparatus for the recovery of large amounts of Pu metal (up to 4 kg), in various geometric shapes, by a hydride/dehydride/cast process (HYDEC) has been built and tested. The hydriding step is carried out in an upper chamber where Pu metal is converted to plutonium hydride (PuH_x), which is in the form of loose black powder ($T < 100^\circ\text{C}$) or metallic looking flakes ($T \sim 250\text{-}350^\circ\text{C}$), the latter being the preferred form. The PuH_x falls from the upper chamber into a heated crucible ($\sim 900^\circ\text{C}$). Upon heating the PuH_x is decomposed into Pu metal and hydrogen. The hydrogen returns to the upper chamber and is recycled to hydride more metal. This recycling greatly reduces ($\sim 80\%$) the amount of H_2 normally required for the stoichiometric reaction. Because the crucible temperature is above the melting point of Pu (640°C), the Pu recovered is molten and can subsequently be poured through the crucible bottom into a copper mold.

The experimental technique will be described in detail and recent results presented. Future plans to introduce an oxidation step, after the hydride/dehydride process, to produce PuO_2 powder suitable for reactor use will also be described (HYDOX process).

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract number W-7405-ENG-48.